SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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NEW CALORIC ENGINE—COMPRESSED AIR COMBUSTION CHAMBER.

The attempt to render the ordinary atmospheric air available as a motive-power has been a favourite subject for experiment with inventors, and numberless plans and theories have been elaborated and engines made with the view to bring the principle into practical operation. Very few, however, of the air-engines that have been built could be made use of, as they possessed but little more power than was sufficient to carry themselves. The first air-engine of which there is any record was made in Scotland more than a century ago. Others were soon after constructed and worked in France, Germany, and other parts, with more or less success. Most of them, however, have been abandoned for defects in some one or other vital point—for their want of durability, for their lack of power, or the difficulty experienced in lubricating them, and preserving the packings from burning out, on account of so much dry heat. Some were given up for want of the proper application of the air; some endeavouring to use it upon the piston directly from the fire-box, thus carrying dust and ashes with it, and destroying the cylinder; others carrying the air into divisions or ovens; others using the air a second time; and a thousand different plans being devised to get at what seemed to be and really was the great secret of success—the proper application of the air.

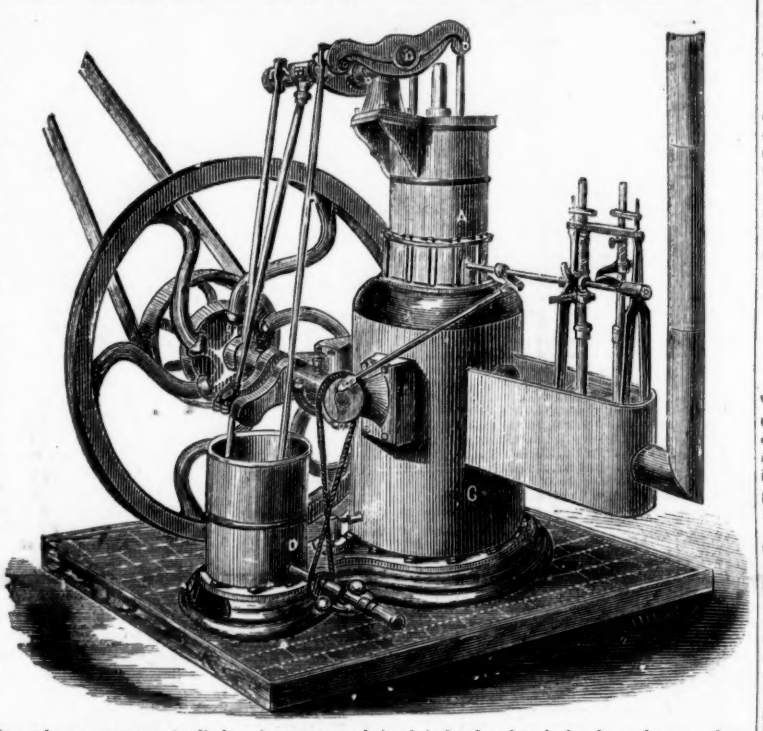
Ericsson, some years ago, brought his skill to bear in the construction of air-engines, and, after spending much time and money, he built one which, compared with all that had preceded it, proved successful. Some of them are still used in England, and stand on their own merits.

Other inventors have tried to use water or steam with air, to produce additional power, and for various assisting purposes, but all such appear to have been disappointed, both on account of the complicated nature of the machinery required, the annoyance and expense of water arrangements, and the constant danger of accidents, which are often occurring, wherever water or steam is used for power; and, further, this sort of combined engine, which really is neither one thing nor the other, is in nowise accomplishing the objects for which air-engines are preferred—safety, economy, and portability.

The foregoing remarks have been suggested by the inspection in operation during the past week of what is claimed to be a perfectly successful hot-air engine, in which the difficulties hitherto attending a successful application of the principle are entirely overcome and done away with.

The inventor of this hot-air engine, after long study and many experiments, found it a settled fact that in order to get the full power of expanded air it must be carried directly into the fire, and from the fire-box be used upon the piston, free from ashes and dust; and that to do this successfully, the engine must be worked with closed air-tight doors, and fuel burned under pressure, so that the pressure in the fire-box holds the ashes, and only a slight vibration is created at each action of the air-pump and piston. By using, in addition, the valve-box and puppet-valves outside, his skill has accomplished what others have failed to do.

The subjoined is a diagram of this hot-air engine, which will now be described more in detail. The peculiarity of this engine is that it does not use upon the piston heated air alone, but the products of combustion as well. The air to supply oxygen for the combustion of anthracite or hard coal is pumped in by pump, D. The carbon is burned rapidly and completely under pressure, and the resulting carbonic acid gas and uncombined nitrogen from the air are passed from the generator, or fire-box, to the piston. The piston is in the form of a hollow plunger, moving in the



cylinder, A, so arranged that it is fitted and packed only at the top, where there is the least heat. In this arrangement the common difficulty of lubricating a hot cylinder, and burning out packings, is obviated. The fire-box, C, inside is surrounded with heavy fire-brick and soap-stone, which prevents burning out the iron, also radiation of much heat into the room. The engine is single-acting. The diagram represents a 2 horse power engine. The diameter of the pump is 12 in., that of the piston 16 in.; and the difference in the area of the pump and piston, multiplied by the usual pressure, eight pounds to the square inch, shows that the engine exerts a 2-horse power, yet with good anthracite or hard coal, good care, and good fire, it can do at least 3-horse power. It requires about 8 lbs. of hard coal per hour, and some twenty minutes' attention, to keep it in working order ten hours. It occupies a space 6 ft. square, a common stove pipe and ordinary flue being all the draft arrangement required. The pipe may be passed around the room in cold weather, or made use of in drying rooms.

To all people requiring but small power the above engine seems to us all that can be desired. It is easy to manage, a boy with a little instruction being able to attend to it. It is portable, free from any danger of explosions, and not affecting insurances it can be placed where steam-engines are not allowed. It is economical, 1 ton of coal sufficing to run it a month; and, with the present price of coals, and the great probability of their growing still dearer, this will be a great consideration. The engine here referred to, which is that mentioned last week as running the new quartz-crusher then described, is in daily operation.

Note on Coal and Cannel.—Although many theories have been suggested to account for the formation of coal beds, all of which agree in the vegetable origin of the coal itself, none have yet appeared which meet many of the difficulties which surround the subject of their origin, and probably they have been deposited under so many varying conditions that no one supposition would account for the difference in the constituents of the mineral, or for the mode of its formation in different localities. From the Stigmaria found in the underclay, in the great majority of cases, it seems fair to assume that the vegetation from which the coal above it was formed grew where the coal is found, and there are other reasons for coming to the same conclusion in these cases, but in some places, where the under-clay is wanting, this may be doubtful. There can, however, be but little doubt that coal and Cannel must have been deposited under different circumstances, and yet in some places they are found interstratified and in contact. This subject was named at the meeting of the British Association at Birmingham, when one of the speakers suggested that the vegetable matter of the Cannel was so far decayed as to be reduced to a pulp, like thoroughly rotted peat, which gave the Cannel its homogeneous structure, whilst that from which coal was formed was less decomposed, so that coal was more like consolidated lignite. It is, however, difficult to conceive how, in the same bed, the vegetable matter could have been first partially decayed, then a layer throughly rotted, and then another only partially decomposed; and yet, if this theory be correct, such must have been the case where the two varieties are interstratified, as they are found near Blackrod, in the Wigan coal field. But there is in most, if not in all, cases a well-marked distinction between coal and Cannel. Though they both are undoubtedly of vegetable origin, the fossils found in them differ. In the body of the coal itself, what fossils are found are almost, if not entirely, vegetable, whilst in the Cannel, at least in that of Lancashire, fish remains not unfrequently occur. Besides this, in the destructive distillation of Cannel for gas-making it is necessary to have the pipes from the retorts much larger than when common coal is employed, because, in the former case, these pipes are very liable to become choked by a deposit, which at first was supposed to be pitch, but which on examination is found to be formed of crystals of chloride of ammonium, agglutinated by tar, from which they may easily be washed out and re-crystallised. May not this large quantity of chloride of ammonium be accounted for by the Cannel bed having been deposited in salt water, the habitat of the fish found in the Cannel; the seawater furnishing the chlorine for this salt? I am fully aware that the distillation of common coal gives salts of ammonium, but they are principally carbonate, sulphate, and sulphide, with very little chloride, and these are all found in what is technically called the ammoniacal liquor. The Cannel also gives these salts in solution in the liquor in addition to the crystals sublimed into the pipes, as above stated. There would be nothing very unreasonable in supposing the growth of a rank vegetation in a swamp on the margin of an estuary, sufficient to form a bed of coal; that this, either by subsidence or by the breaking of a bank, became covered by the sea, and from a fresh became a marine swamp, like the mangrove swamps of the tropics (under which fish feed), and thus accumulate another stratum under seawater, and probably from a different class of plants, until by some fresh alteration of level, or by the accumulation of another bank to exclude the sea, the original state of things was restored, and another fresh water deposit is formed. There might then be a bed of Cannel between two beds of coal, and that such alterations of levels may take place, or have taken place, can scarcely be doubted by any geologist. It does not appear possible, under the supposition that coal results from transported materials, to account for the interstratification above referred to. Possibly, in some instances, independent beds of Cannel may have been derived from a deposit of sea-weed, such as the great weed-bed of the Atlantic.—Jno. Hope, F.G.S.: *Geological Magazine*.

Puddling Iron.—Messrs. Cashin and Allender, of Sheffield, propose to subdivide each puddling furnace in the direction of its length into two or more chambers, by introducing iron hollow partitions or bridges, protected in the usual manner by fire-bricks, cinders, or iron ore. The partitions may be kept cool by allowing water to flow continuously through them; each chamber to be constructed in the form of a parallelogram the full length which the width of the furnace will admit of. Each chamber has a separate door. They propose to use in each chamber a hollow tool, made in the ordinary form, and preserved by water passing through it. This tool is worked by a bar slung from an axle above and in front of the furnace, horizontal motion being imparted by means of an oscillating horizontal lever, driven by a crank shaft. Motion can be communicated to the bar, or stopped instantly, by connecting or detaching the lever from a moveable cylindrical pin, which works in a slot in the slung bar. Intermittent vertical motion is communicated to the tool by cambs attached to the shaft, which at the approaching termination of each backward and forward stroke works into a slot in a vertical lifting bar, slung close to the furnace front. To this bar projections with moveable guides are attached, which lift the tool at each end of the chamber, and regulate its lateral movement. The inconvenience which results from the present mode of removing the slag or clinker which adheres to the furnace grate and retards the operation of puddling, they propose to remedy by substituting for the bars now in use bars let into socketed bearers; these bearers are in length only half the width of the firing place. Each half of the furnace grate is independent of the other, and is borne nearly in equilibrio by a lever at each end, the jaws of which hold a pivot in the middle of each bearer. The pivot at the end of the grate next the outer wall of the furnace is formed with a square end; a barrel key, applied to this end, turns the grate when lowered into a suitable position. The levers are attached on each side of the furnace to an axis, which is prolonged through the furnace wall to receive a balance lever and weight sufficient to sustain the grate in its place, and bear up the fuel upon it.

Puddling Furnaces.—An invention has been provisionally specified by Mr. Dundas Simpson, of Monkland Cottage, Airdrie, which consists in placing a second chamber beyond the ordinary puddling chamber, thus producing a furnace having two puddling or boiling chambers instead of one. The object of the invention is to utilise that portion of the heating products of combustion which under ordinary practice pass into the chimney and are wasted, thus effecting an economy in the consumption of the coal. The second chamber above referred to is placed beyond the ordinary puddling chamber, the two chambers being connected together by a flue, so that the heat which is not utilised in the first chamber may pass into the second, and therein act upon a charge to be puddled or boiled, as in the first or ordinary chamber. After the heat arising from the combustion of the fuel has acted upon the charge in both chambers, the residual products pass off into the chimney as usual. The great advantage resulting from this arrangement of furnace is, that for the same, or nearly the same, amount of fuel as ordinarily used two charges of metal are simultaneously treated, and in about the same length of time as heretofore used for treating but one charge. It is obvious that the same principle of effecting economy in combustion may be rendered useful in any description of furnace from which a large portion of the heat passes away unconsumed.

Improvements in Using Gun-Cotton.—In manufacturing gun-cotton cartridges it has before been proposed to make the charge of gun-cotton occupy a space greater than its own bulk, and it has been found that when using gun-cotton in the shape of yarn, roving, braiding, or muslin good results may be obtained by employing a charge of about one-fifth to one-fourth of the weight of the ordinary gunpowder charge in a chamber of about the capacity of that which gunpowder would occupy. It is found that such charges give good results with a density of charge of about 12 lbs. per cube foot. In addition to causing the gun-cotton to occupy a space greater than its bulk, Mr. J. J. Revy, C.E., of Grosvenor-street, Eaton-square, proposes, according to an invention which he has just patented, to give to the gun-cotton itself a greater individual density than could heretofore be given to it by placing tension on the yarn or braid when winding it round the card-board or other centre, by pressing the same beneath rollers in winding it.

VALUABLE MINING PROCESSES IN AMERICA—No. II.

[FROM A CORRESPONDENT]

The recently-discovered countries, abounding in gold and silver, to which reference was made in last week's *Mining Journal*, lie between the 32d and 48th degrees of north latitude, and extend from the 104th degree of longitude west from Greenwich to the Pacific Ocean, covering an area of more than 1,000,000 square miles. This vast region is divided into twelve states and territories, each of which enjoys the benefit of organised government. California, New Mexico, Nevada, and Collorado are names not unfamiliar to Englishmen.

By reference to the map of the Western hemisphere, it will be seen that the gold and silver producing fields of Mexico, Central and South America, have the same relation with this district to the Pacific coast, and that chain of mountains—the Cordilleras—extending through the two continents of North and South America, holding them together, as it were, like a great chain, with its mighty links of granite, in which are embedded gold, silver, iron, copper, lead, tin, platinum, &c. The Andes of South and the Rock Mountains of North America are but one system—in fact, as they are in origin and in matter; and it is simply impossible that human industry or human ingenuity should ever take from these twin giants a tithe of the treasures with which Nature endowed them at their birth. The portion of country which more immediately interests the reader at the present day was known, until a comparatively recent period, by the rather unsatisfactory title of "The Unexplored Regions." But the discovery of gold in California in 1847, the extreme western limit of this district, stimulated explorations through those parts lying farther inland. These explorations have been persistently continued until the present time, and have resulted in demonstrating that this entire region is both auriferous and argentiferous, while in many localities the ore is greater in quantity, and better in quality, than in any other part of the known world.

Geographically considered, they bear the following relation, beginning on the south side of the great tract, and going west from the 104° of longitude west to the Pacific Ocean. We find—1st, New Mexico; then Arizona, and then the lower part of California. 2d, beginning at the same parallel, is Collorado, then Utah, then Nevada; and lastly, again California. Then, beginning on the same parallel, we have—3dly, Wyoming, next Idaho; and, lastly, the north part of California; and on the northern border, beginning on the 104th degree of longitude, we find—1st, Ducota, then Montana, then Oregon, and Washington Territory, on the coast.

Within the short period since the discovery of the precious metals in these territories a vast amount has been taken therefrom, and added to the commerce of the world, by the simple process of washing the sand of the gulches, and separating the gold from it; but in all these territories veins of metalliferous ore have been found of great width, and of unusually rich quality. These rich formations now only await capital to introduce the requisite machinery to cause them to yield an amount of gold and silver limited only by the amount of labour expended. It is confidently believed by those familiar with the subject that more of the precious metals is contained in these territories, and within the limits given, than is to be found in the balance of the world.

Nor is the productions of the different metals, in quantity, the only feature of prominence in this region. The pastural and agricultural facilities and capabilities are, in many instances, quite as remarkable as the mineralogical character of the country; and it is scarcely necessary to say that for excellence and healthfulness of climate it is not inferior to any known portion of the world.

In these respects there are some striking and distinctive differences between the different territories themselves, as well as in their accessibility, and in the advantages offered for successfully mining and treating the ores, &c., which will be noticed hereafter.

In addition to the existence of gold and silver, in inexhaustible quantities, in this region of country, it is worthy of remark that coal, iron, copper, and lead also are abundant; while timber, and water of the finest quality are distributed all over the region, thus offering the highest advantages to the pioneer setler for the establishment of machinery, and also guaranteeing to him the richest reward for his labour and outlay of capital. The special characteristics and advantages presented by some of these newly-discovered germs of States will form the subject of a succeeding communication.

Coal and Iron in Nova Scotia.—There are now 30 collieries at work in Nova Scotia—some only just opened, but all promising great and profitable extension. The total quantity of round and slack coal sold from the mines during the year was 652,854 tons, being an increase of not less than 30 per cent. upon that of the previous year. The aggregate extent of area under licences is about 1920 square miles. Of the coal sold, 59,536 tons were for home consumption, 52,561 tons were exported to neighbouring colonies, and the rest, 540,757 tons, were exported to other countries—principally to the United States. The coal mines yield a handsome revenue in the shape of royalties and license taxes. Last year the amount was $55 695 08, while the expenses for surveys, "return licenses," &c., fell short of $2000—giving a clear gain of considerable over $ 0,000.—The only place where iron is mined and smelted in Nova Scotia is at Londonderry, Colchester county. During 1865 there were employed about 250 men and boys, and 25 horses. The product was 1600 tons of bar-iron, of which 1500 tons were shipped to England, and the balance to the United States.—*Oil News, Mining and Manufacturing Journal, (U.S.)*

THE TIN-PLATE TRADE.

In our last issue we gave some statistical details of the quantities and values of the export trade in the important article of tin-plate manufacture, likewise the countries to which exported, and the British ports from which the shipments took place. We gave full particulars of the value of plates sent to the United States from 1859 to the end of 1864, which exhibited a sad falling off, owing to the late war in that country. We shall now give some statistics of the prices of common block tin for various periods—taking the London market as our guide, and forming a general average for each year:—

In 1800	Per ton £ 92	In 1842	Per ton £ 73 to £ 67
1806	112	1843	64 to 60
1810	145	1845	78 to 106
1811	128	1850	81 to 84
1813	130	1851	89
1814	150	1852	90 to 98
1815	130	1853	123 to 127
1816	110	1854	130 to 117
1817	92	1856	129 to 142
1818	84	1857	146 to 108
1819	74	1858	Average 119
1820	72	1859	131
1821	90	1860	126
1823	116 to £ 84	1861	122
1826	78	1862	116
1828	72	1863	117
1830	74	1864	110
1834	90 to 126	1865	100
1837	93 to 88	1866 (April)	93
1840	81		

The above may be considered as a fair statement of the general price for block tin since the year 1800. We shall now briefly allude to the quantity of tin smelted in this country and foreign imported, deducting the quantity exported of British tin, and likewise foreign, the result will give us some idea of what we keep for home consumption. In the ten years ending 1859, the tin mines of Devon and Cornwall produced no less than 65,093 tons of metallic tin, of which we exported 26,735 tons, leaving for home consumption 38,364 tons. Of foreign, we imported during the same period 25,324 tons, of which we re-exported 4164 tons, leaving for home consumption 21,160 tons—making a grand total of English and foreign of 59,523 tons, or an increase on the previous ten years of 20,969 tons. The quantity of tin ore smelted is still on the increase, as the following exhibits:—

In 1860	Tons British 6,695	In 1862	Tons British 8,476
1861	7,450	1863	10,006

In 1860 we retained for home consumption about 6360 tons; 1861, 7300 tons; 1862, 7690 tons; 1863, 7540 tons.

We have hitherto only referred to the tin and plate—which, though the most important article as regards value, is still but a trifle in the point of weight. The primary point is more potent than King Copper, who sinks into insignificency in comparison with the king of kings—Iron. The latter forms something like 93 per cent. of what is termed tin-plate. Our exports of tin-plates in 1864 amounted to 80,147 tons—that is, tin and iron. The latter weighed about 47,000 tons, so we did not export any very large quantity of tin in that particular way. We will now give something near the mark of the price of bar-iron, free on board, in Liverpool, for various periods—

In 1850 the average price was..	102s. 8d.	In 1858 the average price was..	140s. 0d.
1851	100s. 8d.	1859	140s. 0d.
1852	115s. 4d.	1860	130s. 0d.
1853	172s. 9d.	1861	115s. 0d.
1854	185s. 6d.	1862	110s. 0d.
1855	159s. 11d.	1863	120s. 0d.
1856	166s. 3d.	1864	130s. 0d. to 140s. 0d.
1857	155s. 9d.	1865	130s. 0d. to 150s. 0d.

In 1866 (April), in Wales, delivered at the works, common coke about 7l. 5s. to 8l. per ton; charcoal iron, from 9l. to 10l. per ton. We may state that palm oil, bran, and oil of vitrol are the remaining articles requisite to commence the working of tin-plates; but the variation of price is not worth taking into consideration. We will now give a few quotations of the prices which tin-plates have fetched in the Liverpool market, for more than half the exports find shipping at that port—nearly all are sent to the United States. The quantities, &c., for a period of ten years may not prove uninteresting:—

EXPORTS OF TIN PLATES FROM LIVERPOOL.

	Boxes.	Canada plates.	Prices. Coke.	Charcoal.
1850	430,194	11,430	27s. 4d.	32s. 1d.
1851	502,895	27,643	25s. 3d.	30s. 3d.
1852	560,211	21,874	23s. 2d.	28s. 0d.
1853	618,370	23,452	25s. 9d.	32s. 7d.
1854	578,677	34,998	26s. 10d.	32s. 10d.
1855	591,274	11,431	26s. 11d.	31s. 8d.
1856	688,622	15,973	30s. 5d.	35s. 10d.
1857	533,814	27,281	32s. 3d.	38s. 0d.
1858	655,547	9,807	25s. 10d.	32s. 2d.
1859	811,051	24,862	25s. 6d.	31s. 10d.

The above is the average price obtained in Liverpool. It will not be necessary to make comparison with the prices of tin-plates at every period of which we have given statistics; but for our purpose we will take April, 1865, and compare with April, 1866. In the former year we find the following in the *Mining Journal*, as quotations in the London market:—Welsh bars, 142s. 6d., at works 20s. per ton—making the price to tin-plate manufacturers about 6l. 10s.; refined tin, 100l.; tin-plates—IC coke, 21s. 6d. to 22s. 9d. per box; ditto, IC charcoal, 27s. to 30s. per box; ditto, second quality, 25s. to 27s. per box: at the works, 1s. to 1s. 6d. per box less. The following remarks are appended:—Charcoals are still a drug in the market, and move off slowly at low prices. There is a somewhat better demand for coke; but prices are wretchedly low, with very immediate prospect of improvement, quoted at 20s. 9d., f.o.b. Yet, with such a gloomy prospect our exports for March amounted to 17,000l. more than the months previous. Their position was, nevertheless, better than the Netherlands Trading Company. In 1864, Banca tin opened at 124s. f.o.b., declined to 104s. 6d., which was paid for 147,000 slabs. Before the closing of the year, 96s. 6d. was accepted, so the English manufacturers had that advantage to commence the year 1865 with. We now turn to the *Mining Journal* for April, 1866:—Welsh bars in London, 8l., to arrive, 7s. 6d. less; we will, therefore, take the price at the works (say) 7l. 5s. for a fair bar; refined tin, 94l.; tin-plates—IC coke, 28s. per box; ditto, IC charcoal, 35s. per box; ditto, second quality, 33s.; at the works, 1s. to 1s. 6d. per box less. Let us put in juxta-position the two periods of 1865 and 1866:—

	1865.				1866.		
Bar-iron	Per ton £	6	10	0	£	7	5	0
Tin		100	0	0		94	0	0
IC coke plate	Per box	1	1	6		1	8	0
IC charcoal		1	7	0		1	15	0

The extra in 1866 for iron is about 11d. per box; in tin, a decrease of 5d., making the addition about 6d. The increase in the price of coke, 5s. 6d., less 8d., makes a profit of 6s. per box since April, 1865, if the account in the *Mining Journal* may be considered correct. For our part, we do not consider that the tin-plate manufacturers are reaping such a splendid harvest for it is very clear to all acquainted with the trade that the price in April, 1865, did not pay; but it was necessary to keep the works on, in order to be prepared for any favourable turn in the market. In support of our view, we need only refer to the annual meeting of the Governor and Company of Copper Miners, which has recently taken place. The report states that 74,000 boxes of tin-plates were made at Cwmavon Works in the year 1865, and the result was a loss of 86l. The trade, therefore, cannot be in that flourishing state as many fancy, for we are constantly reminded that new companies are being formed for the purpose of erecting large tin-works, in order to obtain some share of the fabulous profit which is supposed to be made. A year ago charcoal plates were hardly taken into account, the demand being for coke only. Now the latter has a downward tendency, and charcoal is all the rage, and, considering the high price to be paid for the best iron, and the difficulty of obtaining a good supply of charcoal, the price is not so high as to cause outsiders to reckon upon large profits. The only advantage the tin-plate makers have at present is the low price they pay for block tin, and which, by every appearance, is likely to remain low for some time to come, as the yield increases in greater ratio than the demand. In 1864 it had decreased, by our exporting 1000 tons more than the imports. Fresh tin mines are being opened in Banca. The number of mines there in 1859 was only 452, while no less than 703 were opened in 1860; while such continues to be the case, coupled with increasing quantities raised in Devon and Cornwall, it cannot be expected that any rise in the price, to any great extent, can take place. The price paid for labour at the present time is somewhat in advance of what was paid in April, 1865; that, therefore, will have a tendency to reduce profits on the tin-plate. Already the demand begins to slacken; the makers, therefore, wisely agreed (at the last quarterly meeting) not to advance the prices. We much question the propriety of manufacturers, in any branch, meeting or combining for the purpose of fixing the price for any definite time. If such a system were carried on universally amongst all descriptions of manufacture the country would become a chaos, and stimulate workmen to form combinations of a similar character—a system much to be condemned, especially when resolutions deliberately made by employers are in the course of a week or so scattered to the winds. In most cases of such unnatural agreements to raise the price 1s. or 2s. per box, as the case may be, the Liverpool and London merchants are the only parties likely to reap the advantages, as they invariably have large stocks on hand, waiting for a favourable breeze to thrust them on the market, especially if the Bank rate of discount be at a low figure. Young manufacturers must not suppose that, because a Liverpool or London merchant or broker is desirous of taking all they can make, it arises from a desire to dispose of them at once, or that the demand warrants a quick dispatch—for, though they may leave these shores, and find a resting-place across the Atlantic, they may, nevertheless, remain in bond or in the warehouses of the merchants, still waiting for a favourable breeze to push them on the market. It is a well-known fact, that at the time of the gold mania in Australia ship-loads of every article likely to be of service to those in that country left these shores, and that ship after ship had to return with their freight, as prices had gone down to such a low point that it paid better to bring them back again, as more could be obtained in this country. It may be said that it was not an ordinary occasion—granted; but still it occurs without any undue excitement. A point in support:—The imports of tin-plates to California (according to the official accounts in that country) for the year 1864 amounted to 22,849. In March, 1865, the stock of tin-plates was excessive. Last autumn large sales were made, by auction, at 32s. or 34s. per box. What say the intended tin-plate makers to that? We simply caution and advice not to be too sanguine, for at no period were the makers so capable of supplying the demand as at the present time, owing to works being on a larger scale, and having powerful engine-power, coupled with increased facilities of turning out a large quantity of boxes in a given space of time. It may be taken as a fact, patent to all acquainted with the manufacture, that a tin-mill turns out one-third more boxes in twenty-four hours than the same did ten years ago, and in many cases even double; so we must not take into consideration the number of mills only when forming a comparison. The stock of tin-plates in New York at the close of last year was somewhat small, owing to the merchants simply purchasing "as wanted;" but, the war being over and trade resumed, a degree of briskness may be expected for a few months, though the last advices state the market to be very quiet, and no great demand. The statistics given we leave for the consideration of our readers who may feel interested in the subject. To have gone more fully into the subject, by making comparisons with good and bad times, would have been, perhaps, tedious to our subscribers who may not feel so interested in the subject. We, therefore, preferred making a comparison with April, 1865, and the present time, which, doubtless, will be considered fair and satisfactory. If we have erred in any of our statements, it will afford us much pleasure to be set right. Those, therefore, interested in the manufacture of tin-plate will oblige us by any favours on that subject, which shall at all times receive our best attention. We trust that tin-plate working will become localised, and be to Swansea and the neighbourhood what the cotton manufacture has been to Lancashire, the worsted to Yorkshire, and the lace and hosiery to Nottingham and Leicester. We have no doubt but that in a few years such will be the case. Prosperity and tin-works without smoke will be more gladly welcomed amongst us than King Copper and its noxious influences. The stranger who visits us for business or pleasure will leave us with mingling regrets, instead of murmurs, and wondering how anyone can live in such a foul atmosphere. For the present, we leave the subject in the hands of our readers, but shall make it our duty to pay more attention to this important manufacture than we have hitherto given.—*Cambrian.*

THE TIN TRADE.—Mr. L. Th. van Houten (Rotterdam) writes—Tin has been very dull this month, the apprehension of political difficulties on the Continent and the unsettled state of trade in general causing a further decline. Banca has been in moderate request; in the beginning of the month 49¾ fl. was paid, from which the market gradually declined to 47 fl., closing steadier at 47⅝ fl. The deliveries of 24,192 slabs for this month and of 61,837 slabs for the year are very satisfactory, and show an active export demand. According to a report from the Isle of Banca, the production of tin from the five principal mines has been 58,846 peculs in 1865, against 65,893 peculs in 1864 and 70,848 peculs in 1863. The official return showing the production of all the mines has not yet been published. Billiton has been quiet; 300 slabs were sold at 46½ fl. The following statement shows the position of Banca tin in Holland on April 30, from the official returns published by the Dutch Trading Company:—

		1866.	1865.	1864.
Import in April	Slabs	18,111	12,233	17,450
Total four months		84,141	83,797	66,509
Deliveries in April		24,192	7,650	6,377
Previously this year		37,145	18,857	20,440
Total four months		61,337	24,517	26,817
Stock second-hand		138,992	42,790	48,721
Unsold stock		66,765	163,201	139,475
Total stock		213,453	205,991	188,196
Quotation, April 30	Old terms	—	60 fl	67⅛ fl.
	New terms	47¾ fl	58¼ fl	65⅛ fl.

The preceding returns, compared with those of 1865, exhibit:—An increase of the import for April equal to 184 tons; an increase of the import for four months of 11 tons; an increase of the deliveries of April of 581 tons; an increase of the deliveries for the four months of 1160 tons; an increase of the stock second-hand of 3304 tons; a decrease of the unsold stock of 3027 tons; an increase of the total stock of 247 tons; and a decline in the quotation of 10⅛ fl., equal to 17l. 10s. per ton. The Government returns for the month of February are as follows:—

Import of Tin.	February.			Two months.		
	1866.	1865.	1864.	1866.	1865.	1864.
Germany Tons	183	134	138	319	209	197
Belgium	35	25	56	85	69	73
England	—	16	83	46	31	83
France	55	40	29	106	67	45
Hamburg	40	3	—	52	3	—
United States	—	—	5	96	—	5
Other countries	10	—	3	10	4	9
Total	320	218	314	714	383	412

According to the official returns, the import of tin for consumption in France has been—

Export of Tin.	February.			Two months.		
	1866.	1865.	1864.	1866.	1865.	1864.
England Tons	138	167	148	227	476	314
Belgium	—	—	36	—	—	54
Holland	54	12	60	240	48	158
Other countries	32	45	2	50	79	46
Total	224	224	246	517	603	602

THE COPPER TRADE.—Messrs. J. Pitcairn-Campbell and Co., of Liverpool, report—The same aggravated features of depression previously noticed continue to prevail, and, holders having shown increased inclination to sell, a further reduction in quotations must be made. No improvement can be reported in the demand for English, and second-hand parcels offer at a considerable reduction upon smelters' prices. Advices, however, from Valparaiso, dated March 17, received this morning, indicating rather increasing political complication, should have a somewhat reassuring effect on both holders and consumers, and we hope to see more firmness and activity. The Spanish admiral had taken several cargoes of Chili coals from neutral vessels destined for the northern ports, and this, if continued, must, of course, influence smelting operations and supplies. Shipments for January and February amount to 167,555 quintals, and those of March will, no doubt, bring up the quantity to 250,000 quintals, as estimated in our last. Quotations are 15s. to 15s. 3d. for ores and regulus, 80l. for bars, 86l. to 87l. for ingots; barilla, 16s. 6d. Stock in first and second hands (Chilian and Bolivian) likely to be available—

	Ores.	Regulus.	Bars.	Ingots.	Barilla.
Liverpool	5252	5545	1950	456	25
Swansea	5400	4964	510	578	—

Sales during the fortnight—

April 23.— 29 tons bars, at Swansea, ex Correjora	£79	0	0 per ton.
April 24.—290 tons ore, on spot here, ex William Turner	0	15	3 per unit.
April 25.— 50 tons Cousino ingots, ex San Jose	86	0	0 per ton.
April 27.—355 tons bars, at Swansea, ex Capricon	80	0	0 per ton.
April 27.— 2 tons bars, at Swansea, ex M. A. Holman	80	0	0 per ton.
April 27.— 12 tons bars, at Swansea, ex Hawkeye	80	0	0 per ton.
April 27.—484 tons ore, at Swansea, ex Acacia	0	15	0 per unit.
April 27.—377 tons ore, April 27.—136 tons regulus, } at Swansea, ex Charles Jackson	0	15	0 per unit.
April 28.—200 tons ore, on spot here, Pizarro	0	15	0 per unit.

Arrivals from the West Coast, S. A.—Ores.

	Regulus.	Bars.	Ingots.
Zanga, Callao	430	—	—
Don Enrique, Tocopilla	430	304	—
Grace Fetie, Islay	18	—	—
Spirit of the Day, Carrizal	250	345	—
Worral, Arica	—	—	11
San Lorenzo, Sarco	290	—	—
At Swansea—Stranger, Tongoy	—	327	—

The following are the Government Returns of the exports of articles identified with mining, the produce and manufacture of Great Britain, for the three months ending March 31, 1866; and also as compared with the three months ending March 31, 1865; extracted from the "Accounts relating to Trade and Navigation," published by the Board of Trade:—

DECLARED VALUE FOR THE THREE MONTHS ENDING MARCH 31, 1866.

	1865.		1866.		Increase.
Coals and culm	£ 904,778		£1,022,402		£117,624
Hardwares and cutlery:—					
Agricultural instruments	£88 912	£136,196			
Surgical instruments	118 132	115,220			
Other sorts	677,627 = 891,671	785,989 =	1,037,407		145,736
Machinery:—					
Steam-engines	538,119	310,169			
Other sorts	757,643 = 1,295 792	657,595 =	967,764		
Total	£3,092,241		£3,027,573		
Metals:—Iron—Pig	£252,686	£298,452			
Bar	495,782	578,432			
Railroad	516,791	721,658			
Wire	91,490	109,258			
Ditto telegraphic	26,020	123,974			
Castings	135,067	152,108			
Hoops	299,863	415,164			
Wrought	453,901	587,669			
Old	668 = 2,271,568	6,437 =	2,993,051		721,483
Steel	153,435		251,863		98,428
Copper—Unwrought	63,120	131,020			
Wrought	756,173	358,631			
Other sorts	46,021 = 862,314	17,241 =	506,892		
Brass	50,357	52,519			2,162
Lead—Pig	110,995	148,910			
Ore	31,859 = 142,154	49,095 =	198,005		55,851
Tin—Unwrought	108,498	101,793			
Tin-Plates	305,596	499,939			194,343
Zinc	19,770	35,185			15,415
Grand total	£7,005,933		£7,666,820		£1,351,612
Less decrease—Machinery, 328,028l.; copper, 355,422l.; tin unwrought, 6705l. = 690,155					
Total increase					£660,887

The following are the Government Returns of the Imports and Exports of Gold and Silver Bullion and Specie for three months ending March 31, 1866, from and to the undermentioned places, showing the respective results in favour of and against this country; extracted from the "Accounts relating to Trade and Navigation," published by the Board of Trade:—

DECLARED VALUE FOR THE THREE MONTHS ENDING MARCH 31, 1866.

	Imports.	Exports.	Exports over Imports.	Imports over exports.
Australia	£1,309 859	£ 17,515	—	£1,292,344
Belgium	102,649	17,526	—	85,123
Brazil	64,482	148,756	£ 84,274	—
British Columbia	—	—	—	—
British North America	15,515	—	—	15,515
British South Africa	1,486	—	—	1,486
Egypt	2,414	2,227,837	2,225,423	—
France	204,325	1,320,415	1,116,090	—
Gibraltar	12,506	—	—	12,506
Hanse Towns	542 718	43,180	—	499,538
Holland	24,580	9,215	—	15,365
Malta	—	—	—	—
Mexico, South America, and West Indies	1,479,878	26,858	—	1,453,020
Portugal, Azores, and Madeira	137,525	—	—	137,525
Russia	—	—	—	—
Spain and Canaries	10,074	204	—	9,870
Turkey	—	—	—	—
United States	671,089	592	—	670,507
West Coast of Africa	35,140	22,953	—	12,787
"Other countries"	4,941	4,791	—	150
Total	£ 4,619,171	£ 3,839,213	£ 3,425,787	£ 4,205,796
Less exports				3,425,787
Total imports over exports				£ 779,949

WHAT IS COPPER USED FOR?

The necessary qualifications for commercial life are too often considered to be confined to a general knowledge of book-keeping, the possession of capital, and a feasible opening into which that capital can be turned. For many commercial enterprises, and especially for those connected with home trades, these are no doubt the essential necessities: but when we extend the definition of commercial life, and include therein all those who depend on and devote themselves to transactions with foreign countries, it becomes apparent that for their success they must possess a more extended knowledge. A man who buys to sell again in the same market needs only watch with attention the chief undulations, and their causes, in that one market; but a man who buys an article to ship to a foreign country must not only understand, like the home buyer, the quality and character of the article he buys, but must further be conversant with all the means of communication between the country in which he buys the article and the country in which he purposes to sell it. He must also understand the money exchanges of both the buying and the selling markets. Again, he must keep himself acquainted with the political and social condition of the country to which he is going to ship his goods. And lastly, and above all, he must carefully watch for that wave in the tide of commerce which seems periodically to sweep over all markets, and the gentle rise of which it is often so difficult to distinguish, but which, when it has gained strength in its onward march, rears its crest, and breaks in a commercial panic.

If, now, we accept this enlarged view of the requirements for conducting general commerce, it is apparent that conclusions which the general public draw of the real position of any one staple article of commerce will in most cases, from their limited acquaintance with the innumerable causes which affect its value, be erroneous. We have, in fact, a remarkable instance of it in the case in point—viz., the Copper Trade. Dr. PERCY has said—"It is one man's work to smelt copper, and another man's work to sell it when smelted;" and to which may be added, it is still a third man's work to understand the uses and purposes to which the metal is applied. In short, each branch of this one trade, from the producer of the raw material to the smelter, or converter of the raw article into metal, to the seller who deals in the manufactured article alone, to lastly the consumer, has each and every one so distinct and widely different a field to study, that if he devote himself to his own particular branch of the trade he will find it almost impossible to understand the others, so as to be a competent judge of the real position and value of the metal. The miner cannot always watch with accuracy the changes in the market which consumes his produce. The smelter cannot always appreciate and be fully conversant with the yield and productiveness of the mines, nor can he become familiar with the details of changes in the consuming markets. The seller of the copper (a person who figures pretty considerably in the trade just now) is, of course, still more at sea than the smelter as to the continuance of supply of the raw material in the manufactured form of which he deals. The consumer understands well the causes of change in the consuming markets, but is, on the other hand, totally ignorant of the probable supplies of the article from the mines. The miner seizes on the best facts he can procure, and studies the imports and exports of copper, and argues therefrom that, if the world consumed a certain quantity of copper last year, it ought, if all be true that is said of the progress and extension of English commerce, to consume as much, if not more, this year. The smelter is on safer ground; he says, "I have only to keep a sufficient margin between the article as I buy it and its value in the form in which I sell it"—often indifferent as well as ignorant of the richness of the mines whence he derives his ore. The seller is often satisfied with the statement that this is simply a question of supply and demand, which must settle itself—forgetting how difficult it is to check the supply, from the very nature of mining property, and how many and curiously intricate are the causes of fluctuations in the consuming markets. The consumer says, "I could do well if I only knew what supplies are likely to come into the market." Out of this chaos of combined ignorance and knowledge one may naturally ask, is it not better to meet, as far as we can, the circumstances as they come, and to trust to chance for discretion? No, most decidedly no; for, if there is one thing more certain than another, it is that commercial success is not a matter of chance, but is dependent invariably on the wisdom, sagacity, and experience of those who conduct it.

In these columns, some two years ago, and just when the general public had unanimously decided that the future supplies of copper from Chili must diminish, from the exhaustion of those very rich lodes and deposits from which it had been previously derived, it was stated most distinctly that the notion was erroneous; and how far that statement was correct time and the amount of copper we have received from thence have shown. The assertion was made in the full knowledge that some of the richest mines had ceased to work, and was based not on the fact that some one or two of the most conspicuous mines had stopped, but on a good knowledge of the almost unbounded extent of the copper-yielding districts of that country. This capacity of Chili to keep Europe fully supplied with copper must now be universally admitted; for we have this astonishing proof of her mineral wealth in the fact that, despite there being a hostile fleet in her seas, she still continues to send us copper stuff. In short, she cannot, if she can possibly help it, afford to let her mines go down, for the mineral wealth they yield is the chief source of her revenue. When the public say this over-supply must soon correct itself by closing the less profitable mines, they show, we say, an ignorance of the nature and character of mining property. The miner at home knows only too well that the abandonment of a mine can only be compared to the abandonment of an estate; and the miner in Chili feels this peculiarly, for, from the mining laws of that Republic, if a man who owns a sett allows it to remain unworked for only a few months he loses all right to work it ever after, and the State claims the privilege of re-letting it to the first applicant. Under such circumstances a man hesitates thrice before abandoning what may be even a poor mine, always hoping that what often does happen to others may happen to him—that the lode may suddenly increase in richness; and, knowing that the fluctuations in the demand for mineral produce are so violent and sudden, he satisfies himself with the thought that a depression in the value of produce is always followed by a reaction and an increased demand. There is still another reason why the law of supply and demand cannot so easily affect the production of copper in Chili, and it is this:—Many of the mines are carried on in that country by means of borrowed money, for the local bankers and merchants are generally ready to advance the working capital required by the miner who owns a good sett; thus it comes to pass that if the miner can only pay the interest on the capital he has borrowed, and reward himself for the labour he expends in producing the mineral, he is satisfied, and knows perfectly well that if he does not care to carry on the mine there are many others who will willingly try it instead. These considerations will serve to show clearly that although ultimately the question must be settled by the law of supply and demand, yet that, from the very nature of mining property, the process must be a long one. The time which it will take to show the miner, in the case of copper produce, that he is producing more than it is desirable for his own sake to produce is doubly great, from the circumstance that the producing market is so distant from the consuming markets. If it is difficult for the miner at home to understand the cause of depression in the value of his produce, surely it must be doubly difficult for the miner in Chili to arrive at anything like a right conclusion? The present state of the copper trade is a depressed one, and no one can deny it; at the same time, however, it must be admitted that a turn in the tide will come some day; it may not come this month or next, nor may it even come this year nor next year, but come it will assuredly some day. And as every light which helps to dispel the darkness surrounding the question of *how soon* can but be serviceable, so we propose to answer, as far as possible, the question—What are the purposes for which all the copper the world has produced up to this time been applied? and in answering it in detail, there can be no doubt that some help will be given to elucidate the cause of the present low value of copper. We have the fact to start with, that England has consumed and exported as nearly as possible 60,000 tons of copper annually for the last three years; and, in pushing the enquiry as to the uses to which it has been applied, it is not sufficient that the reply be confined to the statistical lists of exports, but it is necessary to follow the course of the copper further, and to master the uses to which it is applied in practical life. That is the object it is proposed now to attempt.

BRONZE POWDER.—L. Brandies, Brooklyn, New York, claims the production of grains, scrapings, filings, shavings, or borings from copper, tin, and their alloys, by proper tools, like a turning lathe or other tool, to flatten these particles of metal by means of rollers or stampers with polished steel or chilled surface, for the purpose of getting them bright and brilliant, to manufacture therefrom bronze powder in any way used for the purpose of reducing these small flat fragments to still finer ones, always offering a bright surface, just the same as if the metal had passed previously through all the processes of repeated hammering, annealings, rollings, beatings, &c.

THE PORTUGUESE INTERNATIONAL EXHIBITION—No. IV.

BY CHARLES B. KING, C.E.

Among the mining products we find some very interesting specimens. Portugal is essentially a mineral country, and the Government are giving every inducement for the development of these riches, but the enterprise of the Portuguese is stagnant, and a very small proportion of native capital is embarked in these speculations. Machinery for mines is exempt from import duty; the Government freely grant concessions, and it is a fact that our countrymen are at the present time reaping the real benefit from these sources. The St. Domingos Copper Mine is supposed to be the richest in the world; and for the zeal and enterprise with which Mr. James Mason, the proprietor, has carried on these works, and already built the large town of Pomaron, the King of Portugal has conferred upon him the dignity of a baron; this mine was worked by the ancients, or "old men," and there are exhibited some very curious relics of coins, images, &c., found in carrying on the works; also is exhibited on their stand a piece of timber which had been used to stay their underground workings, and although hundreds of years old, is still in most perfect preservation; they exhibit large samples of their ore, from which they make sulphur, &c. The Lusitanian Mining Company show specimens of their mines at Palhal and Carvalhal, which are very rich in copper and lead; grey and peacock copper form a large proportion of these beautiful specimens. The lead mines of Bracal, near the above, opened by Messrs. Feuerheerd and Co., and now being administered by them, show some excellent samples, and a pig of lead; the dres-ing of this lead is very perfect. Messrs. Feuerheerd also exhibit a fire-brick, made by them from fire-clay in the neighbourhood. The Oporto Mining Company, established to purchase and work the concession of the Terradella Mine, belonging to Mr. R. H. Russell, of Oporto, show some very beautiful specimens of silver-lead in quartz, and a small pig; this ore contains by assay 70 ounces of silver to the ton of lead. Mr. Russell exhibits specimens of the Chano Lead Mine, and green carbonate of copper mined from the district of Meda, in the Alto Douro. Mr. José R. Tocha, of Estremoz, shows samples from his mine of Bozalho, which are very fine, and consist of sulphurets, carbonates, and pyrites of copper, and also specimens of malachite and peacock copper. Mr. George Croft, of Lisbon, exhibits in this department samples of the reduction or conversion of copper from ore by electric processes from his factory at Borba. Mr. Adolphe Leuchner, of Oporto, shows a nice collection of minerals and fossils collected in Portugal. Messrs. Chamico and Son, of Oporto, show among other samples tin ore from the mines in the Traz os Montes district; the Companhia Perseverança show fine samples taken from the antimony mines at Vallongo, near Oporto. The slate quarries of Vallongo, worked by Mr. Ennor, and sold by him to the Vallongo Slate and Slab Quarry Company (Limited), show specimens of their slate, which is equal in colour, durability, and general quality to that of the best Bangor quarries. The Coal Company, established to work the coal mines near Vallongo, showed samples, which are the best that can be found in Portugal; which, however, is not saying much, as the veins and seams are too near the surface to produce good coal, equal to that of Wales or Northumberland, but it can be manufactured, as I have proved by a series of successful experiments, into a fuel, which for raising and maintaining steam in boilers is unequalled. It were a great pity that the machinery department was so ill provided, more especially in this country, where the application of steam power to manufacture articles of everyday demand is so novel; how different from our Great Exhibition building of 1862, there the western annexe, which contained the great show of machinery, has up to this time never been excelled. All the nations of the world had done their utmost to exhibit in the most perfect manner, not only the genius of their mechanical inventors and designers, but the result of the intelligence and skill of their workmen. No expense or trouble seemed to have been spared to convey these triumphs of skill from the most distant places. All the mechanical processes by which the raw materials, iron, stone, wood, wool, silk, flax, cotton, &c., are brought from their natural states to that in which they become necessary, useful, or ornamental, and supply the innumerable wants which civilisation necessitates, were seen. The ponderous hammers, by which huge lumps of iron are brought into shape, were exhibited, besides machines which construct the most elaborate and delicate of fabrics; as people know that by visiting such extraordinary collections, like that mentioned, an opportunity occurs for acquiring a knowledge of common things, and will see how nearly everything that surrounds them in their daily life is produced—the furniture of their houses, the carpets on the floors, the table covers, the window curtains, the clothes they wear (in all their varieties), the means by which they travel on land or sea, and how their food is produced. Thus it was for Portugal particularly, and the Exhibition, that this department was so sparsely filled, as the Portuguese require knowledge in these simple matters. Their country is progressing, but as yet they possess no engineers; and the very system they adopt seems to preclude the possibility of their ever having any, as they grant certificates of competency to every engineer who studies at the Ecoles des Ponts et Chausses, in Paris, and passes an examination; he then is quartered on public or other works, and the country pays the penalty of his inexperience. In England seven years apprenticeship to hard work is considered scarcely an equivalent for employment on any work requiring care and caution; while here, forsooth, twelve months is often sufficient. That theoretical knowledge is indispensable no one denies, but without experience to balance it, it is like a pump that will not draw water. This latter remark applies by general consent to France; the French can do almost everything but build machinery, and what they sent to the Portuguese Exhibition is a fair sample of their attempts in this direction. Messrs. Durenne exhibited a portable engine, with sole-plate, on which the engine was erected, fixed to the boiler; this firm also exhibited a horizontal engine, and some very good fancy iron castings. Another French exhibit was a portable engine and threshing-machine; the latter was similar to some of our English machines, but I cannot compliment the designer of the engine on his success: one good thing about it, however, was the governor, which was on the principle of the gyroscope, and should work well. Giffard's injector was applied, but the main fault was the disproportion of its parts—for instance, the eccentric rods were flattened at the end, and as thick as the connecting rod, while the dimensions of reversing link can be imagined. M. Letestu, of Paris, exhibited a flood-pump, and one of his patent fire-engines; the same as exhibited in London; and from France came a very good set of boring tools; a portable vertical sawing-machine will conclude the list. In motion was a combing-machine, a hackling-machine, and two power-looms for woollen fabric; these excited some interest. The Arsenal of Marine in Lisbon sent from their factories a small lathe, a fire-engine, two punching and shearing-machines. The Bicalho Foundry, Oporto, a screw-cutting lathe and small pumps. The Massarillos Foundry, Oporto, a small screw-cutting lathe, a pump, and specimens of their iron founding. Mr. A. de la Roque, Oporto, a collection of American machinery, pumps, ploughs, a Worthington duplex reciprocating steam-pump, a root extractor, a horse-power accumulator, and winnowing machines. Several smaller implements were exhibited by Portugal, but the whole proved a very inferior show.

The Portuguese colonies sent a very interesting collection of their native wood and manufactures, such as leather mat-work, shawls, jewellery, and spices, conserves, and condiments; these were displayed with much taste in the Hippodrome, forming one of the annexes to the main building.

The collection of wines were, on the whole, a good testimony of the staple commodity for which this country is famed; the port wines of old vintages of Antonio B. Ferreira, Chamico and Sons, and many others, were very tastefully displayed for exhibition. Clarets and other French wines were also sent to make up this collection.

The Commissioner of Woods and Royal Forests displayed interesting specimens of the various woods growing in the country. Tobacco from the Brazils, Havanna, and Hamburg formed also a prominent feature.

Germany sent a collection from its various manufactures, the carved ivory work and upholstery from Hamburg being admired; the ornamental leather work of J. L. Meyer, from Vienna; whetstones, boots and shoes, pianofortes, lace work, India-rubber manufactures, and some beautiful clocks and carved meerschaum pipes, rendered a very effective display. Cloths from Saxony, glass from Bohemia, and a number of sewing-machines included in the articles of merit.

Having briefly described the contents of the Exhibition, I can only express a hope that the effect upon the industry and weath of the nation may be increased by the effort, however meagre, to prove useful to the world at large. Portugal is but a small country, but its natural productions, fertile soil, and beautiful climate, renders it capable, when the population increases, of very great things. Labour at present is cheap. Free trade in mines has already been granted by the Government, and other indications of social and mercantile progress are showing themselves. Let us, then, conclude by expressing a hope that she will continue to be successful and prosperous, and for some time to come be free from those political ruptures which are the bane and misfortune of so many continental countries; her alliances with England continue strong, and her Governments are liberal. This great work of peace just finished may be another means of cementing her friendships, and forming strong and powerful alliances with other countries; so that should the time come, which we hope may be far distant, when she calls for assistance it will be freely granted; she will hold her own, and maintain her prestige among the nations of the world.

ON THE SMYRNA, OR WESTERN ASIA MINOR, COAL AND IRON FIELD.

BY DR. HYDE CLARKE.

While attention in Turkey is exclusively directed to the Heraclea coal field, in Northern Asia Minor, a series of discoveries is developing a much larger area of formations in the Smyrna district; but as yet they have attracted little local notice, beyond paragraphs in railway reports, as they have been neglected by capitalists and the Imperial Government. This district has been altogether omitted in the allotment of surveys by the Imperial Department of Mines.

As Mr. Wm. Swann, of Constantinople, formerly of South Wales, has published a sketch of the Heraclea coal field, it may be useful to give some notes on the Smyrna field. The existence of coal at Sokieh and Nazlu has been known for some years, but the subject has not been systematically followed up, although I have repeatedly applied to the Imperial Government and the Ottoman Railway Company, and have made several efforts for that purpose. One great difficulty is, that in Smyrna there is no local organisation. So far as I know, the coal district begins outside the cretaceous formations, about nine miles from Smyrna, near Jumovassi and Seidekene, and extends across the valley of, the Cayster, to that of the Mæander, on both sides of which discoveries have been made. It reaches, so far as I can judge, to the head valleys of the great basin of the Mæander. As the like formations are recognised in the valley of the Hermus, they must for the present be considered as continuous with the Mæander formations. The nuclei and backbones of Western Asia Minor consist chiefly of mica schist; and, as this formation extends to Constantinople, it is possible that coal and iron fields will be found in intermediate places, forming a connection with the European Black Sea and the Marmora coal fields, and with the Heraclea coal field.

The coal sites recognised are as follows:—Jumovassi, discovered in 1864, and reported by me to the Government. This was offered to me as a gift by the Government, but on such onerous terms that I declined it. It is near Seidekene and Jumovassi, about three or four miles from the railway, at the foot of the Almalu or Mount Corax range. It extends, perhaps, for a couple of miles, and crops out. The coal is a lignite, or light bituminous coal, superior to Nazlu or Sokieh. This is worthy of examination, as it is only nine or ten miles from Smyrna.

Sokieh, discovered ten years ago, and for which a firman was obtained by Mr. S. O. Clarke, of that town. The situation is about ten miles from the Balachik station, on the Smyrna and Aidin Railway. The coal is surface, and is a very friable lignite, wasting in two days. It is used for the engines of the English liquorice factories of that town. There have been great difficulties about the firmans of these mines. The Sokieh district produces emery stone in abundance, and silver-lead mines have been discovered. [About two miles from Aziziel station, near the old Ephems Pass, there is a likely formation for lead, and in the tunnel of the Aidin station, near Aziziel, near the new Ephesus Pass, mundic was found in the continuation of the range to the north; in the old Salatus tunnel copper ore was discovered].

Magnesia ad Mæandrum, or Tekeh, three miles from Balachik station, and seven miles from Sokieh. Ibrahim Bey, the proprietor of this place, reported to me last year that he had discovered coal like Sokieh coal, soon after my visit; but I have received no specimens, and have not been able to go to the place. Magnesia ad Mæandrum was the Birmingham of these parts, as I discovered first from its medals, and afterwards from examination on the spot. At the back of the city are vast slag heaps. The iron I consider to have been obtained from the neighbouring hills, and not from the Besh Pennak.

Nazlu coal field was discovered above ten years ago, and has been very partially worked for the liquorice establishments of the town. The present workings I found to consist of surface diggings in dislocated strata, and on that spot there is no appearance of any extensive formation. The coal appears to be lignitic. Here, likewise, there were difficulties about the firman, so that the working was impeded. Nazlu is 30 to 35 miles beyond the Aidin station, in the line of the extension which must be made. The coal is very useful for various purposes, but in a prospective point of view the formation is of importance, because it attests the mineralisation of the south slope of Messogis, in a valley of which, leading to Ballyambo, is the coal mine. It is to be observed that in the Cayster Valley and south side of Tmolus I know of nothing, but both Tmolis and Messogis—the boundary mountains—are mineralised. Birdik coal was in March found by Mr. Charles Simes, at Birdik village, 50 miles beyond Nazlu: it is a poor seam, about 2 feet thick. I have not yet received specimens. In the north, in the Valley of the Hermus, only one coal site, so far as I know, has yet been discovered. This is a fine-looking coal, answering well in the cotton-spinning factories of Keurk Aghaj. It is reported to be extensive, and has been, I believe, examined by Mr. C. Austin, C.E.

With regard to IRON, the sites are—Magnesia ad Mæandrum: this is not yet well ascertained. The Besh Pannak Mountains, forming the great southern range in the Mæander Plain, opposite Aidin. Here is an abundance of fine hematite iron ore, got out in pits by the Chingains or gipseys, and worked with small charcoal furnaces, in the Hindoo fashion. From this district Aidin, Nazlu, and many other towns are supplied with horse-shoes and nails. The iron is very fine, and said to be particularly suited for making steel. Demirji Derch, one of the great valleys of the Mæander, I consider to be an extension of the Besh Pannak district, but as yet I have very little information. The City of Laodicea appears to have been in the Roman period the seat of an iron manufacture. As to the northern district of the Hermus, I have also general indications only, but the coins of Thyateira, now Ak Hissar, give evidence of its being, like Magnesia and Laodicea, the seat of an iron manufacture. What is wanted is a survey of the Smyrna district by a practical mining engineer, in order to ascertain its real capabilities. If the opinions of those who have only cursorily examined it be correct, it is one of the most promising districts of Asia Minor. I have strong reasons for thinking that the district will, on examination, redeem its ancient reputation as a gold country. The Smyrna and Aidin Railway is now nearly completed to Aidin, and the Smyrna and Cassaba Railway is open to Cassaba. These greatly facilitate the explorations of the district; and should the indications justify large operations, the railways communicating with the best port, and a commercial city of 200,000 inhabitants, will afford valuable assistance.—*Smyrna, April* 13.

MINERAL INDUSTRIES OF THE ZOLLVEREIN.

In connection with the Mining Statistics of the Zollverein the coal and iron returns are entitled to especial attention, on account of the intimate connection which exists between these minerals as regards price, a cheap production of coal insuring a cheap smelting of iron ore, and as these two stand foremost in the list of the most important articles of industry and commerce, and conduce most largely to the comfort and well-being of the population in general. In 1863 there were 671 coal mines at work, employing 90,561 workmen, and producing 338,134,152 Zoll-centners (centner= 1 cwt. English), valued at 28,489,558 thalers; there were 843 anthracite (lignite?) mines, employing 20,060 workmen, and producing 109,189,899 centners, valued at 5,061,241 thalers; and there were 2018 iron mines, employing 23 540 workmen, and producing 47,494,909 centners of ore, valued at 3,915,992 thalers. A comparison of these figures with those of the two preceding years shows throughout a considerable increase both as regards production and value of the produce at the place of extraction.

The increase of production as regards coal amounts to 55,473,183 centners; anthracite to 16,743,658 centners; and iron ore to 11,329,508 centners. In addition to the above-mentioned, the following quantities of minerals were produced in the year 1863:—Gold and silver ore, 694.288 5 centners; quicksilver, 55; lead ore, 3,216,948; copper ore, 2,811.586; zinc ore, 5.833 864; tin ore, 4273; cobalt, 35,775; arsenic ore, 39.290; antimony, 5.247; manganese ore, 364.847; vitriol ore, 792.263; graphite, 16.977; asphalt, 10.300; fusible spar (fluss spath), 105.543 centners. In 1863 the whole number of mines in use amounted to 4457; the number of workmen employed was 178,777; 509 089,314 centners of ore were extracted, which was valued at 46,462,395 thalers. In 1861 the number of mines was 4975, giving employment to 167.538 workmen; 425 357,813 centners of ore were extracted, valued at 42,302,953 thalers. By a comparison of these two years, 1861 and 1863, it appears that in the latter there was a decrease of 518 in the number of mines, but an increase of 11,239 in the number of workmen employed, and of 837,731,501 centners in the quantity of ore extracted, and an increase in the value of the produce by 4,159,442 thalers.

In 1863 the position of the forges and smelting-works was—

	Works.	Produce.	Value.	Workmen.
Wrought-iron	307	14,611,477 cent.	18,880,530 thrs.	15,301
Ditto for steel	6	447,969	817,525	124
Cast-iron made from ore	40	1,191,661	3,614,026	5,683
Cast-iron made from wrought-iron	339	3,363,809	12,414,413	17,284
Bar and rolled iron	489	6 716,185	22,120,681	25 221
Sheet-iron	34	1,224,621	5,620,523	2,784
Iron wire	169	633,638	2,971,949	2,583
Steel	177	1,085,009	7,733,613	9,487

As was the case with regard to the mines, these returns also show a generally satisfactory increase.

The smelting works within the Zollverein produced in the year 1863, besides: gold, 91·97 Zollverein lbs. (in Saxony, 79·3 lbs.; in the districts common to Hanover and Brunswick, 12·1 lbs.; in Prussia, 0·5 lb.); silver, 136,512·5 Zollverein lbs.; lead, 661,412 centners; litharge, 73,859 centners; sheet lead, 12,437 centners; refined copper, 62,622 centners; worked copper, 51,032 centners; brass, 38,878 centners; zinc plates and bars, 1,206,309 centners; zinc plates (thin), 266,385 centners; white of zinc ("zincweiss"), 39,332 centners; tin, 2207 centners; mineral blue, 18,825 centners; nickel, 12,099 centners; arsenic, 11,801 centners; antimony, 1570 centners; alum, 52,810 centners; vitriol, 91,209 centners; and sulphur, 7052 centners. Whereas in the year 1861 the whole smelting business comprised 1596 establishments, with 77.453 workmen, and a production of 25,729,331 centners, valued at 86,392,162 thalers. In 1863 the number of establishments had increased to 1775, giving employment to 91,076 workmen, who manufactured 33,885.394 centners of metals of all kinds, valued at 105.521,946 thalers. There appears, therefore, an increase of 179 in the number of establishments, of 13,623 in the number of workmen, of 8,156,063 centners in the quantity of metals produced, and of 19,129,784 thalers in the value of goods.

The produce of the saltworks in the year 1863 amounted to 8,601,102 centners, as against 6,818.842 centners in 1861. The first-mentioned amount consists of 2,712,509 centners of rock salt, 5,560,120 centners of kitchen salt, 183,982 centners of black and yellow salt, and 144,491 centners of salt for manures, of the aggregate value of 6,139,222 thalers. The number of works was 90, and of workmen employed 6148.

The statistics show that within the short space of three years an extraordinary increase has occurred in the production of the mines, forges, and salt works of the States forming the Zollverein. Although in that period of time the number of establishments has decreased by 347, the number of workmen has increased by 25,016, the production by 95,140,303 centners, and its value by 22,563,443 thalers.

TREATING AURIFEROUS SULPHURETS.

In connection with the treatment of auriferous sulphurets, several processes are in successful operation in Colorado and the neighbouring States, and a cheap and effectual process has been recently devised by Messrs. PEER and MANNING, by which the roasting of the ores can be effected in a furnace that may be economically constructed for the purpose, and without the necessity of undertaking the manufacture of crude sulphur and bisulphide of carbon, which are comparatively valueless in the market. According to Messrs. Peer and Manning's invention, a square brick furnace is erected, with the ordinary square fire-box in it, and two small semicular boilers are so placed in the fire-box as to leave a space between them for the passage of the entire heat upwards to the hearth, around which the fumes pass. Two steam drums are placed in the brickwork above the boilers, which furnish sufficient steam to run any quantity of machinery desired, as well as for the use in the furnace, which shall be described presently. The hearth of the furnace, the most important part of the invention, is constructed either of soapstone or fire-clay tiles, and is enclosed on all sides except the top, so as to prevent either the draft or flame coming in contact with the ore heaped up on its surface. The sulphurets are mixed with a definite quantity of powdered charcoal and fine salt, well moistened with water, and are then packed closely upon this hearth, to the depth of from 8 to 12 in., according to the capacity of the fire-box for fuel. The mass is suffered to lie undisturbed for from three to five hours, when steam is injected under the ore by means of a series of small pipes, supplied from main pipes connected with the steam-drums. No attention is necessary except to keep the temperature of the mass at a red heat for at least three hours, when the steam is let on for 20 minutes to force out what sulphur may remain, and complete the oxidation of the particles of iron. Stirring is unnecessary; in fact, it would be fatal to the operation. A high arch is constructed above the hearth, of sufficient area to allow of the expansion and free passage of the gases arising from the hearth. The flues from the fire-box also pass into this arch, and the draft carries off all the fumes as soon as they have risen to a proper distance from the mass of ore. No particles of mineral matter, be they light or otherwise, can rise from the hearth, because there is no current to carry them up. The heat is never raised so high as to volatilise even silver. And if even this should be the case, they are provided with a condenser of an improved construction, which will condense and precipitate all metallic fumes into a receiver, where they may be collected and saved. Charcoal is used for fuel because it is the cheapest, giving out the most heat in a specified time, and is without the dense fumes and flames that accompany other species of fuel. Where steam can be had from boilers already erected, the furnace may be built without them, and supplied by a connection with the exhaust-pipe or any other. This furnace is built with doors at each end for both fuel and ore, so that, for a hearth of the length of 10 ft. there is but 5 ft. distance to work upon. The mass of ore, when the oxidation is complete, is raked into a chute and conveyed into the pan for amalgamation. Another batch may then be placed upon the hearth in the same manner. The hearth may be built of any size, to hold a ton or more, without enlarging the fire-box to more than 9 ft. square feet, and by extending the flues. As an economical and sure method of roasting sulphurets, this furnace process meets the approbation of all practically scientific men who have examined it and tested its merits. To the impracticable theorist it can, of course, only be a wonder, which it were a waste of time to explain. The philosophy of the discovery is this:—The sulphurets being intimately mixed with powdered charcoal the sulphur combines with it in a great measure, and is consumed with it and passes off in its fumes. Just sufficient salt is used to assist in disengaging the sulphur from the ore, but not enough to form a chloride with the gold or silver. The decomposition of the water in the mass allows the hydrogen to combine with a portion of the sulphur, and this, being light, rises into the current and is carried off through the chimney. Raw steam injected through the mass soon becomes superheated and decomposes, and the oxygen combines with the iron while the hydrogen carries off what sulphur may still linger in the heap. The burning of the powdered charcoal leaves the mass porous and permeable by the injected steam, so that every particle of the ore receives the benefit of it. The most refractory ores of all descriptions may be treated in this way. Neither arsenical or antimonial ores can resist this treatment. They only require a little longer time than ordinary sulphurets.

KEITH'S process, so long maturing, is now succeeding admirably. There can be no question that those using it are extracting on an average 200 per cent. more gold from the ore than by the ordinary stamp mill, and that, too, at an expense not more than 25 per cent. in advance of the old method. The process may be described as similar to that of Messrs. Crosby and Thompson's desulphuriser—that of operating upon powdered ore by the action of heat and oxygen, the method of application, however, being different. By this process no cylinders are used, the ore being forced by a strong draft through a brick furnace and long flue, by which the ore is roasted and smelted in the air. It is claimed by this process, as well as by that of Messrs. Crosby and Thompson, that the infinitesimally fine particles of gold are aggregated in small round pellets or globules. This would seem to be conclusive upon an examination of the gold with a strong glass. Many of these small globules appear to have a small concave indentation upon the surface, while others appear to have burst open from the natural shrinkage of the ore from a molten state. The expense of this process would seem greater than that of Messrs. Crosby and Thompson, while the result cannot be more satisfactory, and it certainly has not the merit of equal simplicity; but, from the fact that this process has been and is now successfully at work, it would at the present moment seem to stand ahead of any other.

According to Messrs. CROSBY and THOMPSON'S process, the ore is first crushed dry, by stamps, and then fed by a continuous stream into a large revolving cylinder, made of strong sheet-iron. This revolves above and between two other revolving cylinders of the same size, all of which are heated by fire beneath. The upper cylinder being further removed from the fire beneath the two lower cylinders (the whole number being confined in a brick work), is not hot enough to dissipate the sulphur contained in the powdered ore, but is sufficient, it is claimed, to throw off the arsenic and antimony, and whatever quicksilver the ore may retain, when it consists of old tailings from stamp and pan mills. The cylinders are not quite horizontal, being depressed at one end sufficiently to make the whole time of passage through about thirteen minutes. After passing through the upper cylinder the ore passes, equally divided, in a hot state, into the two cylinders beneath, which being in contact with the fire are much higher charged with heat than the upper one. The lower cylinders revolve upon hollow axles, some 5 or 6 inches in diameter, open at both ends. The axles, as they pass through the centres of the two lower cylinders, are perforated with many holes, through which air is supplied to effect with heat the desulphurisation and oxidation. The powdered ore, as soon as it is introduced into the lower cylinders, and in a highly heated state, comes in contact with the oxygen supplied through the holes in the hollow axles, burns with brilliant scintillations, exhibiting the most varied colours. Before reaching the further ends of the lower cylinders it has ceased to burn or emit colours, and forms in a vessel beneath, thoroughly desulphurised and oxidised, ready for the amalgamating process. That this process does thoroughly free the ore from sulphur, and destroy the original nature of the iron, no one can doubt who has witnessed its working. The difficulty now to overcome is that of amalgamation. Still a vast deal more gold can be secured from ore treated by this process in Freiberg or Hepworth Pans than could previously be obtained in the same pans from raw ore. A spray chamber, so called, is connected with the cylinders, through which the strong draft from the cylinders passes. This chamber is supplied by a flow of water which percolates through the upper surface, cooling the heated air and condensing the finer particles of gold, which otherwise would pass out the chimney. Large results are claimed from this addition, and possibly the amount may be equal to 5 or 10 per cent. of the whole.

"COAL GAS.—During the distillation of coal or cannel, in the manufacture of gas, Mr. Israel Swindells, of Wigan, admits superheated steam into the retorts among the charge; by so doing the bisulphide of carbon liberated during the distillatory process is decomposed and carried forward by the gas to the purifiers in a condition for which the ordinary purifying agents have great affinity. He lays perforated pipes along the bottom inside each retort, and connects such pipes with

others leading from the superheating apparatus in which the temperature of the steam is raised. When a charge of coal or cannel is thrown in, a small quantity of steam is admitted through the pipes and by the perforations amongst the charge, but when heat has reached the mass then a larger quantity is allowed to enter, the admission being controlled by valves or taps.

AMERICAN MINING STATISTICS.

BY DR. R. P. STEVENS.

The value of the mining interests of the United States is increasing in quantity so rapidly that, from one national census to another, we can hardly keep track of it. Indeed, the measure of its statistics is so imperfect, or so interwoven, that we cannot draw conclusions from one decade to another. Enough, however, can be gained from the census reports of 1850 and 1860, to show that some mining interests increase at the rate of 30 per cent. I propose to look a little into the statistics of the last report, and see what useful lessons can be gained from it. The sum total of all mining economies and others closely allied to them, such as quarrying of marble, digging of clays for pottery, sands for glass, &c., amounted to $305,398,000. The precise value of raw material raised from mines was about $100,000,000, which was equal to the value of the live stock of New York, or one-tenth of the whole country.

IRON.—The number of States engaged in mining was ten—Pennsylvania, Michigan, New Jersey, New York, Missouri, Massachusetts, Connecticut, Maryland, New Hampshire, and Ohio. The rank, in the amount produced, is in the order named. New Hampshire and New Jersey raised mainly the magnetic ores, New York the magnetic and hematites, Connecticut hematites, Pennsylvania and Ohio raised the argillaceous ores of the coal measures, and Missouri and Michigan raised the compact red and brown oxides. In the wide geological range of our country every variety of this mineral is found and utilised: 150 mining establishments were engaged in raising iron, employing 3177 men, and paying them in wages nearly a million of dollars. The capital reported was $2,91,527, while the value of the products was $7,723,860. If we add interest at 7 per cent. to the capital, and the amount paid for wages, we have $3,20 ,000 in round numbers. The product is more than twofold.

The importance of iron thus mined assumes a far greater magnitude when we examine the manufacturing interests immediately connected with and dependent upon it. There are 97 bloomeries, 246 furnaces, 286 rolling-mills, 16 mills for drawing iron wire, 17 car-wheels manufactories 1112 establishments for castings, 19 for locomotives, 74 for sewing machines, 249 for arms, 413 for hardware, 382 for steel, 99 for nails, 134 for scythes, 14 for printing presses: total 3546, employing $33,153,625, and giving labour to 104,120 workmen, and paying them annually $45,202,363. They earned for their capitalists $ 82,724,976. From this sum there should be deducted the amount manufactured from foreign importations. We have still, after liberal allowance, $125,000,000 from American iron, against a capital of $81,000,000.

COPPER.—Another great mining interest, our mines of native metal, exceed those of all other nations. Up to the present time more than one-half of all the product of our mines is from this source. There are 42 mining establishments, producing 499,544 tons of ore, employing a capital of $21,400,000, and giving labour to 5639 men, and paying them $1,791,503 in wages; the sum total of product was $3,978,282. The rank of States in production was as follows:—Michigan New Mexico, Tennessee and North Carolina. The smelting business growing out of this branch of mining amounts in the aggregate of home production and foreign importation to $6,622,000, employing a capital of $7,405,000, and 914 hands, whose wages amounted to $231,400. Growing out of the smelting business, and connected with it, are 191 establishments engaged in copper and brass working. The number of hands is 2144, and wages $871,2 4, and capital $1,105,450, and total value of work produced $5,955,553. We estimate about one-third of this amount is chargeable to American raw material, or $1,985,184, product of American mining of copper and zinc.

COAL.—We raised 15 000,000 tons of coal, giving employment to 36,469 workmen, and paying them in wages $9,650,000; the value of their labour in coal raised at the mouth of the mines was $20,000,000 against a capital of $39,428,670. The following curious calculations can be made from the amount of coal thus raised. The dynamic power of all force may be estimated, and usually is, by units of heat. The mechanical power of this amount of coal is equivalent to the muscular power of 5,250,000 of horses; or, reduced to man power, it would be equivalent to adding to our working force of men 42,000,000, working eight hours a-day, supposing the whole amount raised were utilised in generating steam. But suppose only one-half were used for this purpose, still we have an equivalent of 21,000,000 of working men added to our population. Conceive, for one moment, the effect upon our city if it were derived of this fuel. Every steam-engine would be stopped, every building deprived of gas, darkness would be in our streets and dwellings, and there would a return to the old tallow dip for the poor; with kerosene, paraffin, and wax for the rich: 36,000 men, woman and children would be out of employment, and the amount of city manufactures would fall off at once $50,000,000: 4,000,000 tons of bituminous coal, foreign and domestic, was manufactured into gas. The increase of value of the American portion was $9,0 0,000. The manufacture of gas gave employment to 5481 workmen, and paid them in wages $2,901,264. From the consumption of gas arises the mechanism of gas fixtures of all kinds. This branch of art employed 2093 men, using a capital of $3,000,000, and paying them nearly $1,000,000 in wages. The amount of capital employed was $3,0 0,000.

LEAD.—The census reports are remarkably deficient in their statistics upon this metal. Missouri and Iowa, well-known producing States, are omitted, while in Wisconsin mining and smelting are merged together. The sum total of mining, smelting, and manufacture was $12,000,000.

SILVER.—The report is also deficient in this metal. Only one mining establishment is reported, and this in California, producing $810,000. The silver manufactures amounted to $5,006,000.

GOLD.—7202 mining establishments are reported. Eight States and territories were engaged in this business. In the amount produced California took the lead, New Mexico followed, then succeeded Oregon, North Carolina, Georgia, Virginia, and finally South Carolina. These establishments raised $17,586,000. The amount expended for labour was $23,253,000, while the capital employed was but $12,119,865.

Twenty-two States were engaged in the manufacture of gold, having 452 establishments. The capital employed was $10,895,320. The number of workmen was 6198, and the amount of their wages was $ 4,469 800.—*American Journal of Mining.*

NEW INVENTIONS.

PROVISIONAL PROTECTION for six months has been granted for the following:—

S. RICHARDS, Cremy House, Bishopsgate-street Within.—Improvements in machinery for boring rocks. April 5.

E. B. MUSPRATT, Liverpool.—Improvements in burning, calcining, and preparing for burning or calcining copper, iron, and other ores containing sulphur, for obtaining sulphuric acid. April 7. [iron. Ap il 20.

G. HASELTINE, Southampton-buildings.—Improvements in the manufacture of sheet-

J. J. BODMER, Newport.—Improvements in the treatment of slag or cinder from blast-furnaces, copper smelting and other furnaces, and in apparatus employed therein, which improvements are also applicable to certain processes in the manufacture of iron and steel. April 12.

S. F. SCHONMAKER, Great Russell-street.—Improvements in machinery for breaking stones, ores, and other hard substances. April 14.

C. E. BROOMAN, 166, Fleet-street.—Improvements in crushing, separating, and washing ores and other substances, and in apparatus employed therein. April 17.

J. G. JONES, Blaina Ironworks, near Newport.—Improvements in machinery employed in cutting or getting coal and other minerals. April 18.

LETTERS PATENT have been issued for the following:—

H. BESSEMER, Queen-street-place.—Improvements in the manufacture of iron and steel, and in apparatus employed in such manufactures. Nov. 3.

J. B ELKINGTON, of Newhall-street, Birmingham.—Improvements in the manufacture of copper from copper ore. Nov. 3.

J. PRANGE Liverpool.—Improvements in the manufacture of steel. Nov. 7.

T. WHITWELL, Stockton-on-Tees.—Improvements in furnaces for heating the blast of blast-furnaces. Nov. 10.

G. H GOODMAN, London-road, Surrey, and E. Bow, Maidstone.—Improvements in machinery for crushing or reducing stone, quartz, emery, and other mineral substances. Nov 13.

SPECIFICATIONS published during the week:—

Extracting copper, &c., from their ores, 4d.; manufacture of iron and steel, 4d.; purifying coal-gas, &c., 10d. L. DE FONTAINEMOREAU.

THE PURCHASERS OF COPPER, ZINC, AND LEAD ORES.

The principal COPPER ORE PURCHASERS are—

Vivian and Sons	Swansea.
Freeman and Co.	Whitebrick, Swansea.
P. Grenfell and Sons	Middle & Upper Bank, Swansea.
Sims, Willyams, and Co.	Llanelly.
Williams, Foster, and Co.	Swansea. [Swansea.
Mason and Elkington	Birmingham, and Pembrey,
Bankart and Sons	Red Jacket Works, Swansea.
Copper Miners' Company	Cwm Avon, Taibach.
Charles Lambert	Port Tennant Works, Swansea, and Wood End Copper Works,
Newton, Keates, and Co.	Baglilt. [Widnes Dock.
Sweetland, Tuttle, and Co.	Neath.
Pencla wdd Copper Company	near Swansea.
Hadland and Co.	Dan-y-Graig, Swansea.
British and Foreign Copper Company	Ystyitty Works, Llanelly.
Ravenhead Copper Company	St. Helen's.
Mona Smelting Company	Isle of Man.

The principal ZINC ORE PURCHASERS are—

Vivian and Sons	Swansea.
J. H. Attwood's Executors	Carlisle.
S. Kenrick and Sons	Ruabon.
Baglit Smelting Company	Baglilt.
J. Collingborn	Bristol.
H. Southern	Ruabon.

The principal LEAD ORE PURCHASERS are—

Joseph Walker, Parker, and Co.	Dee Bank.
Newton, Keates, and Co.	Baglilt.
Adam Eaton	Llanerchymor.
Sims, Willyams, Neville, and Co.	Llanelly.
Thomas Somers	Bristol.
The Panther Lead Company (Limited)	Bristol.
William J. Cookson and Co.	Newcastle.
Locke, Blackett, and Co.	Newcastle.
The Trustees of Tr ffry's Estate	Pen, St. Austell.
John Bibby, Sons, and Co.	Liverpool.
The Mining Company of Ireland	Dublin.
Robert Michell and Son	Truro.
Stock and Co.	Swansea.
Falmouth Smelting Company (Limited)	Falmouth.
James and Josiah Williams	Bristol.
Runcorn Smelting Company	Runcorn.
Shield and Dinning	Langley, near Haydon Bridge.

SALES OF COPPER ORES.

COPPER ORES SOLD AT THE CORNWALL TICKETINGS FOR THE QUARTER ENDING MARCH, 1866:—

Mines.	Tons.	Amount.
Devon Great Consols	6819	£29 435 10 0
Clifford Amalgamated	3886	14,603 15 0
South Caradon	1598	13,581 15 6
West Wheal Seton	1446	8,475 2 6
Hingston Down	1165	5,304 5 0
Wheal Seton	987	4,666 13 6
Wheal Basset	840	4,332 5 6
East Carn Brea	981	4,186 15 6
Marke Valley	1128	4,004 8 0
Prosper United	1052	3,936 0 6
East Caradon	950	3,811 19 0
Wheal Friendship	551	3,801 2 6
West Basset	615	3,570 5 0
Fowey Consols	650	3,240 6 0
Wheal Rose	800	3,064 16 0
Pheenix	963	2,753 1 6
North Treskeroy	398	2,009 3 0
Okel Tor	655	1,988 13 0
East Rosewarne	252	1 915 3 0
Wheal Margery	581	1,898 13 6
East Wheal Russell	369	1,843 3 6
West Caradon	363	1,833 18 6
East Pool	417	1,810 19 6
Bedford United	421	1,715 18 6
Wheal Emma	249	1,617 8 0
South Wheal Frances	255	1,525 2 0
Ranpsyllie	105	1,520 10 0
South Wheal Tolgus	326	1,518 4 0
New Wheal Martha	801	1,508 16 0
North Roskear	256	1 400 6 6
Great Wheal Busy	553	1,304 10 6
Devon and Cornwall	450	1,201 5 6
West Wheal Damsel	335	1,110 4 6
Tincarne	237	1,071 15 0
Bookwood	259	1,017 1 6
South Condurrow	123	879 8 6
Craddock Moor	177	858 6 0
Carn Camborne	210	832 3 6
Rosewarne United	128	7 8 12 6
Copper Hill	212	772 17 0
South Wheal Crofty	144	771 18 0
Carn Brea	207	753 14 0
Dolcoath	104	745 15 0
Par Consols	122	742 16 0
Wheal Curtis	186	666 13 0
Gunnislake (Clitters)	164	655 5 6
Gonamena	253	632 10 6
Glasgow Caradon	161	628 11 0
West Wheal Tolgus	157	621 5 6
Great North Downs	158	602 8 0
Great South Tolgus	137	581 13 0
East Basset	74	431 11 6
Gaston Copper	144	52 17 0
Wheal Crebor	132	506 13 6
Levant	99	492 18 0
Wheal Buller	108	492 16 0
New Rosewarne	72	484 16 0
Bullaick	87	477 8 0
West Stray Park	58	462 17 0
Wheal Creiske	110	446 5 0
North Crofty	44	143 10 0
North Grambler	77	440 12 0
Wheal Polmear	90	4 6 5 0
Lady Bertha	200	435 0 0
New Cornish	99	417 0 0
North Basset	116	407 12 0
East Wheal Grenville	120	387 9 0
St. Day United	74	315 1 6
Tincroft	65	306 18 6
Rosewarne Consols	40	288 6 6
Tolvadden	56	285 8 0
Wendron Consols	24	278 0 0
Hallenbeagle	84	259 10 0
Pendeen Consols	75	253 2 6
North Downs	51	229 10 0
Kelly Bray	62	222 0 0
Wheal Kitty	35	217 0 0
Nangiles	83	214 9 0
Meltonner	80	2 4 8 0
Grambler and St. Aunyn	31	190 14 0
Molland	55	184 12 6
Fursdon	48	164 17 0
Crowan Consols	33	163 17 6
Boscaswell	24	161 8 0
Treleigh Consols	43	157 16 6
South Dolcoath	29	149 1 0
South Carn Brea	35	143 10 0
Wheal Union	16	141 4 0
Wheal Polharmon	25	120 18 0
West Beam	14	126 14 0
South Grylls	17	108 7 6
Wheal Grenville	17	104 19 6
North Wheal Robert	29	97 3 0
Wheal Harriett	18	90 0 0
Walkham and Poldice	25	91 0 0
Brawidden	10	76 19 6
Spearne Moor	3	72 2 0
Sortridge Consols	27	64 2 6
Hawsmoor	24	61 4 0
Pendarves United	21	57 15 0
Wheal Edward	20	52 10 0
Killifreth	8	51 12 0
Wheal Hartley	7	53 1 0
West Condurrow	10	41 15 0
Treloweth	10	47 5 0
Higgins's Ore	8	40 0 0
South Crinnis	18	36 14 0
Crane	6	38 5 0
Wheal Clarence	12	37 10 0
Providence	5	35 15 0
Camborne Vean	10	35 0 0
Collacombe	13	34 9 0
Wheal Uny	5	25 12 6
Cook's Kitchen	11	23 18 6
Boscawen	7	19 15 6
Daniell's Ore	5	19 0 0
Enys's Ore	12	18 12 0
Pembroke	2	4 0 0
Harris's Ore	2	3 1 0

COMPANIES BY WHOM THE ORES WERE PURCHASED:—

Vivian and Sons	6364	£30,703 18 5
Freeman and Co.	2468	12,504 10 3
P. Grenfell and Sons	3641	21 405 2 10
Sims, Willyams, and Co.	4705	18,196 12 8
Willyams, Foster, and Co.	5982	32,425 18 5
Mason and Elkington	3 78	14,037 8 2
Bankart and Son	2134	7,200 5 8
Copper Miners' Company	2458	11,226 19 2
Charles Lambert	3499	11,724 11 8
Newton, Keates, and Co.	1765	6,074 4 9
Sweetland, Tuttle, and Co.	214	1,142 8 6
Pencla wdd Copper Company	273	893 7 6
Hadland and Co.	248	958 18 6
Total	36,711	£167,493 4 6

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